Journal of Mathematics and Applied Statistics
Vol. 1, No. 2, December 2023

Analysis of Spatial Ability in terms of High Self Efficacy

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ABSTRACT

This research was conducted to find out and describe how students' spatial abilities are viewed from high self efficacy. The type of research used is qualitative with a case study approach. The subjects in the study were students with high questionnaire results from the questionnaire categorization results. The technique of taking subjects is purposive sampling, before choosing the subject the researcher gives self efficacy questionnaire to all students of class VIII Al-Qalam. Furthermore, the questionnaire was categorized, then obtained three subjects with high self efficacy. Researchers collected data with questionnaires, document analysis and interviews. In this study the researcher acts as the main instrument, while the supporting instruments of this study are questionnaires, interviews and documents. The data analysis technique used in this research is by collecting data, reducing data, presenting data, and drawing conclusions. The data validity test used is credibility test, transfebility test, dependability test, and confirmablity test. The results showed that each subject with high self efficacy has different and similar characteristics in answering spatial ability questions. All subjects can fulfill the spatial ability indicators well. So it can be concluded that subjects with high self efficacy are able to fulfill spatial ability indicators and have good spatial abilities.

Keyword: Spatial Ability; Self Efficacy

Article History:
Received, 18-10-2023; Revised, 11-11-2023; Accepted, 02-12-2023.

1. Introduction

Spatial ability leads to the field of Geometry and is very important for students to master. In learning Mathematics, the things that must be considered are geometry and spatial, so that all students can use visualization and spatial to solve problems within the scope of Mathematics (NCTM, 2000). Based on what is stated by NCTM, it is clear that the ability is very important to be mastered by students. In line with Sherman's (1980) opinion that spatial ability is part of the main factors to influence mathematical ability. In previous research by Hutagulung and Harahap (2018) at SMP Negeri 1 Pinangsori class VIII school, found that spatial ability was low. This is evidenced from the questions given to students with data showing that 92.31% of the total number of students get a spatial ability interview score in the incomplete category, because it does not reach the KKM which is 75 with the average value of students obtained ranging from 20-60. From this it can be seen that spatial ability is still lacking.

This is also in accordance with the research of Faradhila, Sujadi & Kuswardi (2013) found that from the daily tests of junior high school students in grade VIII Geometry space material shows, the results of student answers are less and far from the minimum completeness criteria. This is due to the lack of students' ability to imagine images in visual form, causing low student achievement in mathematics. From this, it is concluded that students' ability is still lacking in converting a picture into a real form.

Researchers have conducted preliminary studies with interviews and observations. The interview was conducted with one of the Mathematics teachers at SMPIT Ulul Albab, from the results of the interview obtained information that students' Mathematics ability to solve problems was still low. Students' enthusiasm and motivation in learning Mathematics

decreased due to online learning during the Covid 19 pandemic. This can be seen from students' mistakes when asked to solve math problems. Students still understand better the example problems explained by the teacher but do not understand the concept first so that students cannot understand the meaning of the given problem. In addition, the teacher added that in solving Mathematics problems, students tend to give up when they are unable to work on a problem so that students look at their friends' answers or cheat on their friends' work.

The researcher made observations in the classroom during Mathematics learning, and saw that students tended to ask for answers and ask their friends if they were unable to answer the questions. This can be caused by students' lack of confidence. In addition to the need for spatial abilities in learning geometry, one of the other important things is the attitude of students in learning mathematics, namely self efficacy (Hidayah, Johar & Ikhsan, 2016). Self-efficacy has a close relationship with spatial ability so that it can foster a positive attitude in solving Mathematics problems related to Geometry. Self efficacy can affect a person's ability to complete spatial tasks, and vice versa, spatial ability can affect a person's level of self efficacy. This is in accordance with the research of Ing, Chen, & Sun (2018) which explains that the level of self efficacy in spatial tasks is associated with actual spatial ability, and the significant role of self efficacy in improving spatial ability. Lin and Petersen (1985) in their study showed that students who have high self efficacy are better when completing tasks involving spatial problem solving. Furthermore, Bandura and Newcombe (1983) stated that good spatial ability can increase a person's confidence in his ability to complete mathematical tasks in this case involving space and shape. So it can be concluded that spatial ability and also self efficacy have a positive relationship and can affect the ability to learn mathematics and student achievement.

The positive relationship between self-efficacy and spatial ability will make students able to master Geometry material. The Self efficacy itself according to Bandura (1997), is an individual's belief in his ability to carry out activities or actions to achieve a predetermined goal. Bandura and Locke (2003) state that self-efficacy shows that the level of student confidence in their ability to solve various mathematical problems is getting better. This spatial ability is important especially for learning Geometry, but it is also important for the development of scientific and technological progress. Many previous researchers conducted research with different focuses. In this study, researchers want to examine spatial ability by reviewing from different perspectives, which may be a factor in the lack of student ability in learning geometry. One of the factors in question is self efficacy. Therefore, researchers are interested in analyzing students' spatial abilities in terms of self efficacy.

2. Method

This research uses a qualitative method using a case study approach. The research subjects in this study were students with high self efficacy based on questionnaire categorization. Before selecting the subject, the researcher distributed a questionnaire in the form of a self efficacy statement to all VIII Al-Qalam class students totaling 22 students. Furthermore, the questionnaire results were categorized and selected subjects with high questionnaire results. Based on the results of the questionnaire categorization, only 3 students with high questionnaire categorization results so that the researcher immediately took the subject as a research subject. JS, AAR, & PPC are students who have a high level of self-

efficacy category. Of the three students, they will be given a spatial ability test The following is a list of names of research subjects with high questionnaire results.

Table 1. Subject Code Self Efficacy

Subject Code	Category
JS	High
AAR	High
PPC	High

In this study the researcher as the main instrument and supporting instruments are questionnaires, interviews and documentation. The data analysis technique used is the data analysis technique according to Miles and Huberman (1984) containing data collection, data reduction, data presentation, and conclusion drawing. The data collected in this study in the form of interviews of students' spatial abilities and self efficacy, after the data is obtained then the researcher sorting the data or data reduction, the researcher sorts out the necessary data and discards those that are not needed After being reduced, the data is presented in the form of a description of students' spatial abilities and self efficacy and conclusions are drawn regarding spatial abilities in terms of high self efficacy.

3. Result and Discussion

Self efficacy

Based on the results of the questionnaire related to self efficacy statements, subjects with high categorization results chose positive statements that lead to high self efficacy abilities in accordance with self efficacy indicators. Researchers conducted unstructured interviews with students regarding their answers based on the questionnaire. The researcher asked each subject about how the subject's confidence when in class, and how when the subject gets a difficult problem, does he answer or avoid it. Each subject answered confidently, subject S1 said that he was a person who really believed in himself and always did tasks or demands both difficult and easy independently. Subject S2 answered that he was sometimes confident, but when answering questions he always answered according to his ability and believed in his abilities. While subject S3 answered that he always did the task independently according to his ability when he could not do it he would ask the teacher and ask for an explanation from the teacher.

From the results of the description above, it is found that students with high questionnaire results are students with high self efficacy, namely students who are able to fulfill every aspect of self efficacy. Students who have high self efficacy are also able to answer the spatial ability interview well. This is supported by the opinion of Bandura (2003) who says that students with high self efficacy have stronger motivation, feel more able to overcome obstacles, and dare to take risks in learning. Based on the same source, Bandura (2003) says that students with high self efficacy have a strong belief in their ability to succeed and succeed in various tasks and situations. They believe that the efforts they make will produce positive results and that they have control over their success or failure. In addition, Fitriani (2017) argues that high self-efficacy students will be able to motivate themselves in learning so that their learning outcomes will be satisfactory. Sunaryo (2017) added that high self efficacy will

encourage students' mathematics achievement to be better.

Spatial Visualization

Spatial visualization or spatial visualization is the ability of students to interpret what is in their minds into a real form. The following are the answers from subject S1, subject S2, and Subject S3 on statements related to spatial visualization indicators

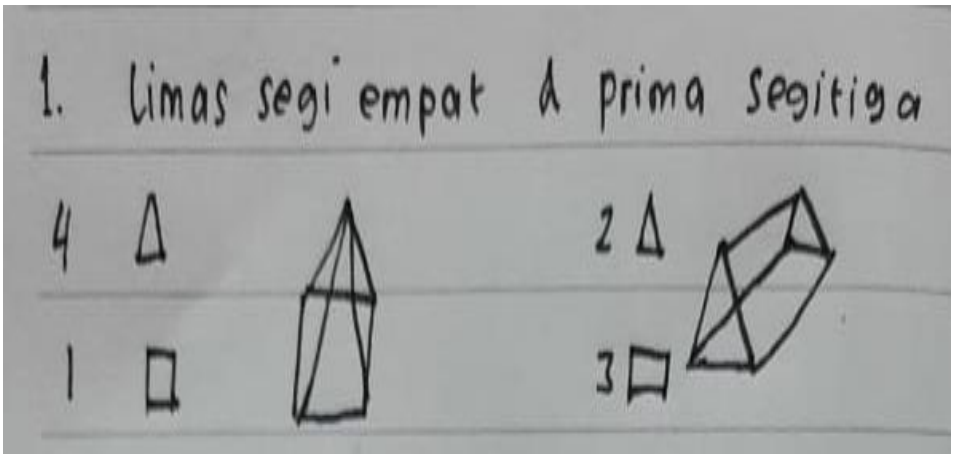

Figure 1. S1 subject's answer spatial visualization

Based on the answers of subject S1, it is obtained that subject S1 is able to answer the questions properly and correctly subject S1 is able to describe the spatial building of several flat shapes that are combined. So it can be assumed that subject S1 has good visualization. Based on the results of subject S2's answers to questions related to spatial visualization, subject S2 was able to answer correctly and was able to describe the building space well. From the results of the interview, subject S2 was able to explain his process in answering the question well. The following are the results of subject S2's answers to spatial visualization questions.

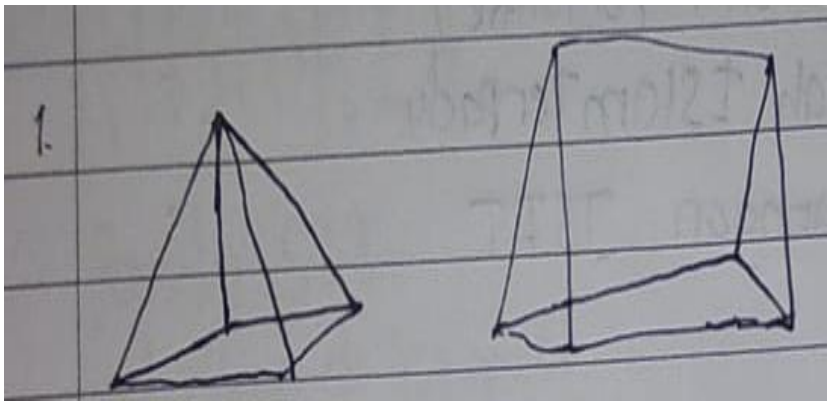

Figure 2. S2 subject's answer spatial visualization

Based on the results of Subject S3's answers, Subject S3 is able to describe the shape of the space from the combined results of several flat shapes as shown in the figure, although the subject S3 is only able to describe 1 space, but it can be assumed that subject S3 has visualization skills because it is able to interpret its imagination into real form. Based on the

interview excerpt of subject S3 explained S3 answered because that's all he got then he described. The answer of subject S3 can be seen in the following figure.

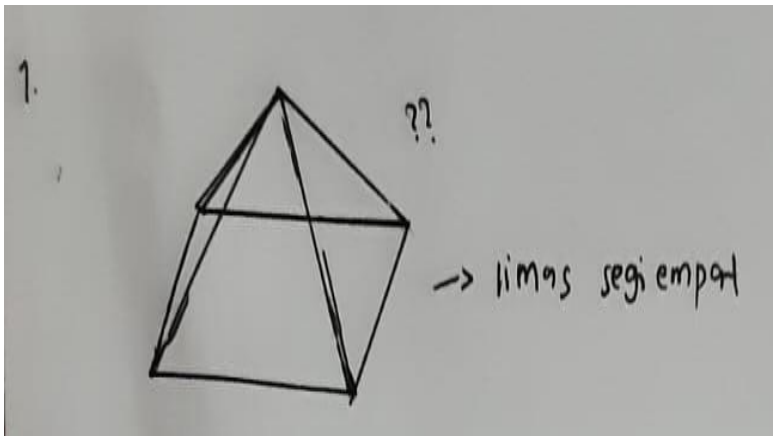

Figure 3. S3 subject's answer spatial visualization

Spatial Orientation

Spatial orientation atau orientasi spasial adalah kemampuan untuk memahami penampilan objek dari arah atau perspektif yang berbeda. Berikut adalah jawaban dari semua subjek dari pertanyaan spasial orientasi.

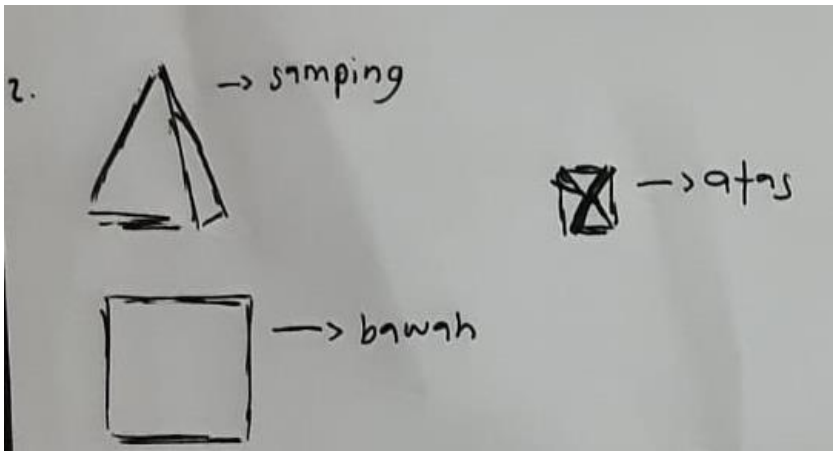

Figure 1. S1 subject's answer *spatial orientation*

Based on the answers above, subject S1 seems to be able to determine the appearance of objects from different points of view or different perspectives, from the subject S1's answer it can be seen that he describes the appearance of the object from the side is a triangle, from below a square and from above is a rectangular pyramid. from this it can be assumed that subject S1 has good spatial orientation skills, from the results of the interview also subject S1 is able to explain how the process answers the question.

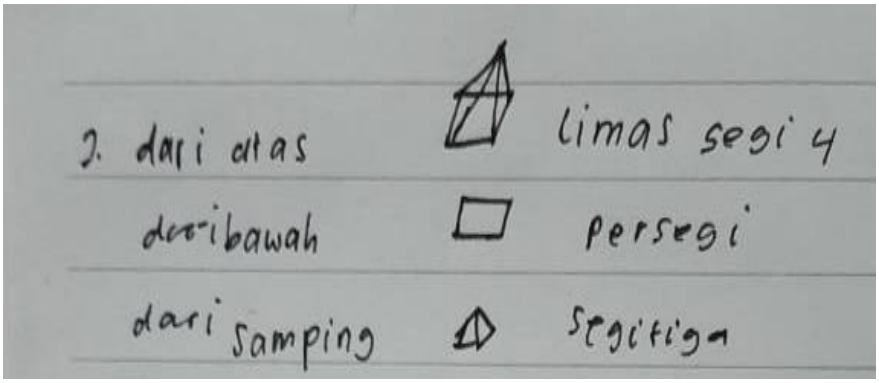

Figure 5. S2 subject's answer *spatial orientation*

The picture above is the answer of subject S2 related to spatial orientation questions, it can be seen that subject S2 was able to answer well. Subject S2 is able to determine the appearance of objects and describe the shape of objects from various points of view. From the results of the interview, subject S2 was also able to explain the shape of each object he drew from various points of view. The following are the results of subject S3's answers to spatial orientation questions.

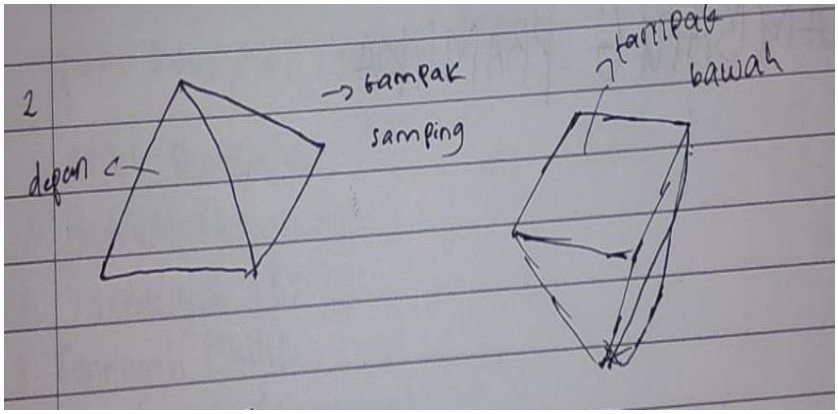

Figure 6. S3 subject's answer *spatial orientation*

Based on the results of subject S3's answers on the spatial orientation indicator, subject S3 can describe the appearance of objects from various points of view as seen in the picture. Subject S3 describes the appearance of the object from the side in the form of a triangle, from below in the form of a rectangle and from above shaped like a pyramid. Although subject S3 does not describe the appearance of the object from the front. But from the results of the description it can be assumed that the subject S3 is able to know the appearance of objects from various points of view.

Spatial Relation

Spatial relation is the ability to understand the relationship of an object with other objects and the ability to understand the position or location of an object after rotating its shape. The following will present the answers of subject S1, subject S2 and subject S3 related to

spatial relations. subject S1 is AAR as the first respondent, subject S2 is JS as the second respondent and subject S3 is PPC as the third respondent who was selected based on the results of the questionnaire.

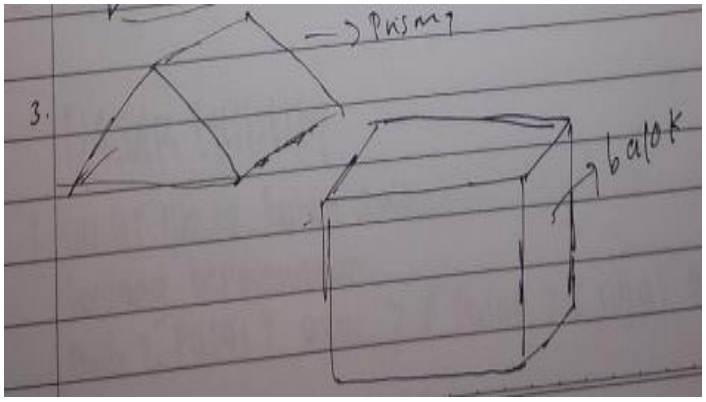

Figure 7. S1 subject's answer spatial relation

Based on the results of subject S1's answers, it can be seen that subject S1 describes prisms, blocks and cubes. From this it can be assumed that subject S1 is able to understand the relationship of an object with others, from the question asked to determine the spatial shapes that can be combined and form a miniature house. Subject S1 was able to understand the question and answer the question well.

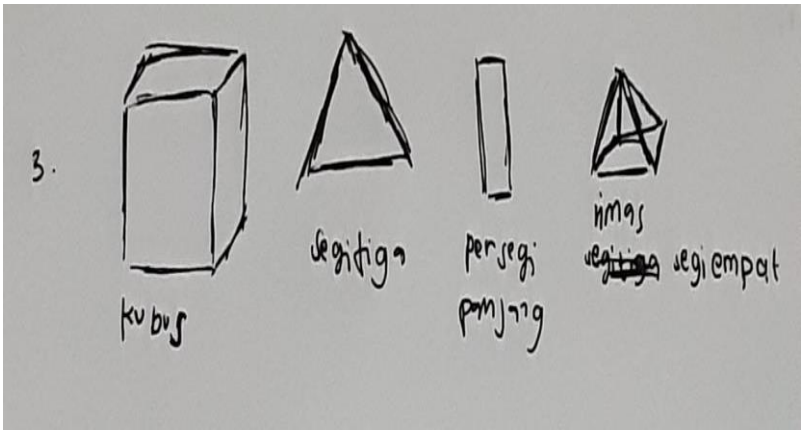

Figure 8. S2 subject's answer spatial relation

The picture above is the answer of subject S2 from questions related to spatial relations based on these answers, it can be seen that subject S2 is able to describe the shapes that can be formed into a miniature house, although the pyramid and beam drawings described by subject S2 do not follow geometric rules, where the shape described by subject S2 is less than perfect, but subject S2 is able to imagine and connect these objects in order to form a miniature house. From the results of the interview, subject S2 explained that the buildings that can form a miniature house are prisms and beams. Subject S2 also explained which part of the miniature house the building was located in. The following are the results of subject S3's answers to spatial relation questions.

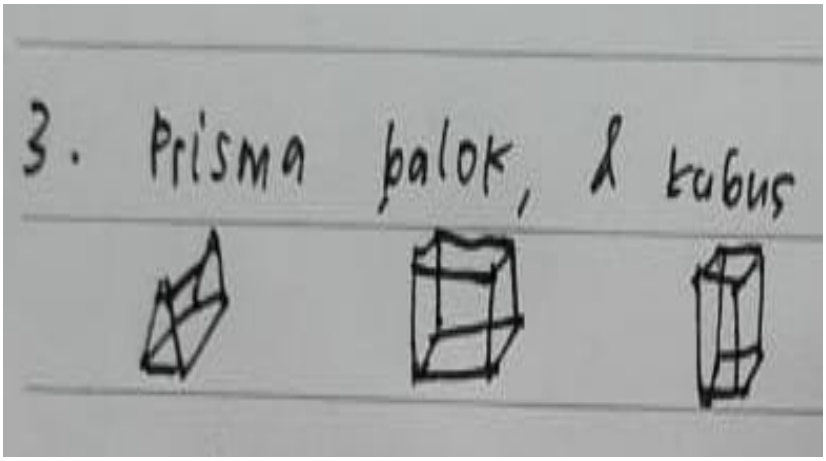

Figure 9. S3 subject's answer spatial relation

Based on the results of the answers of subject S3 related to spatial relation indicators. Subject S3 is able to describe the shapes that can form a miniature house, but subject S3 is wrong in describing the space and flat shapes that can form a miniature house. From the results of the interview excerpt, subject S3 was able to explain which part of the miniature house he described. Subject S3 explained he combined the space and flat buildings, because there is a flat building in the miniature picture of the house.

Based on the results of the research and the results of the answers of all subjects related to spatial visualization, it is found that all subjects have good visualization, there are similarities from the subjects in answering question 1, namely in imagining and combining several flat building objects into a space, but there are also differences from each subject in answering the question. Where subject S1 in answering directly describes according to the question, subject S2 answers by imagining first, while subject S3 is able to imagine and describe but only 1 that he can describe. From this it can be seen that all subjects can meet the indicators of spatial visualization and have the characteristics of students with good visualization. This is in accordance with research conducted by Hasanah (2021) that students with good visuals are able to visualize things in their minds and then convert them into real form well. Students with a visual learning style use the sense of sight more, which means that vision can be realized by seeing or imagining activities as a conceptual depiction in processing information. Based on the results of the research, namely the answers and interview results related to spatial orientation, it is obtained that all subjects are seen that there are similarities from each subject in answering questions related to spatial orientation, namely all subjects are able to describe and determine the appearance of objects from different points of view. Subjects can also imagine real objects that are shaped like a space.

In addition to the similarity, there are also differences from the three subjects, namely in the process of answering questions related to spatial orientation. From this it can be seen that all subjects have good spatial orientation abilities. As stated by Teapon and kusumah (2023) that students who have spatial orientation abilities will easily understand the concept of relative directions such as front, back, left and right. Students are also able to recognize the location of different objects and places. In addition, another opinion, namely according to Lohman (1996),

says that students who have good spatial orientation skills usually have the ability to visualize the appearance of objects in space and are able to determine the appearance of objects from various points of view.

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Based on the results of research findings obtained that there are differences and similarities in each subject with high self efficacy in answering spatial ability questions. The difference between each subject is the difference in characteristics in answering spatial ability questions and the similarity of each subject is from the subject's answer on each indicator. In the spatial visualization indicator, all subjects were able to describe the spatial structure in their minds into a real form, in the spatial orientation indicator, all subjects were able to determine the appearance of objects viewed from different points of view. In the spatial relation indicator, all subjects were able to determine the relationship of an object with other objects and were able to determine the position of the object after rotating its shape. All subjects with high self efficacy are able to fulfill the spatial ability indicators and have good spatial abilities, and among the three subjects with good spatial abilities. The subject who has the best spatial ability among the three subjects is subject S2, this is obtained from the way subject S2 answers spatial ability questions, Subject S2 is able to fulfill all indicators of spatial ability. In imagining or visualizing the shape of the 3-dimensional space object in his mind into a real form, subject S2 is better when compared to subject S1 and subject S3. In addition, it is also seen from the high self-efficacy of subject S2.

Spatial ability is necessary for success in any subject, one of which is geomancy. Students who have spatial abilities will have various positive impacts in their education and development (Istifarida, 2017). Students' spatial abilities will be more improved, especially in terms of problem solving if students have high self-efficacy. Alfurofika (2013) said in her research that students with high self efficacy ability increased mathematical problem solving ability. Thus, self efficacy can have a significant impact on one's spatial ability, and conversely, improved spatial ability can also help build higher self-efficacy. Therefore, developing self-efficacy in spatial ability can help individuals achieve better in various tasks involving spatial aspects.

4. Conclusion

Based on the research findings, differences and similarities were obtained from each student with high self efficacy in answering spatial ability questions, but all subjects with high self efficacy were able to answer spatial ability questions and fulfill spatial indicators well. So it can be concluded that all subjects with high self efficacy have good spatial abilities. The suggestion from this research for future researchers is to dig deeper into students' spatial abilities in learning mathematics so that a good learning design can be prepared

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